**CSCE 823: Machine Learning**

**Summer 2020**

**Student Topic Presentation**

**Overview:**

The student topic presentation gives students an opportunity to investigate and teach a lesson about an advanced machine learning topic of current interest. The opportunity first requires students to submit a proposal containing details on three topics of interest. Using these proposals, the course instructor will develop the presentation schedule for all students during weeks 6-10 of the course. Once assigned a topic, the student should study the area and develop a lesson (to include pre-lecture activities, learning activities and a live presentation). During weeks 6-10, each student will give a live presentation for approximately 20 minutes, allowing for a question and answer period of 5 minutes. Joint presentations are possible, but each student is expected to contribute effort equivalent to performing the task on their own. Presentations will be evaluated by the course instructor.

This assignment constitutes 20 points towards the course score – 5 points for the proposal and 5 points for the content and presentation.

**Requirements (4 components) :**

* Topics Proposal (due 27 July) [5 pts]
* Learning Activities (due NLT 72 hours prior to live presentation) [5 pts]
* Presentation materials (due NLT 24 hours prior to live presentation) [5 pts]
* Live Presentation (25 min) on MS Teams during course meeting time in week 6-10 [10 pts]

**Grading Criteria:**

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| **Area** | **Criteria** |
| Topic Proposal | Completeness, Quality |
| Learning Activities (readings, code, web demos & interactives) | Correctness, Usefulness, Quality |
| Presentation Materials / Visual Aids (slides) | Correctness, Usefulness, Quality |
| Live Presentation | Preparation & Readiness, Usefulness, Quality |

**Topic Proposal Details:**

(Due 27 July 2020 – 5 points)

In a MS Word document or PDF:

Put your full name in the beginning of the document

Below your name, indicate any timing constraints or preferences - i.e. desire to present early in the quarter or in a specific week; absence from class due to TDY / work requirement - or indicate 'No scheduling preference'

Indicate 3 topics in preference order from first to last.  Be specific - for example, instead of stating “autoencoders” give the specific type of autoencoder(s) you are interested in presenting and perhaps details of the presentation (e.g. Variational Autoencoders for imagery). Your topics may be selected from chapters 13-20 in the Goodfellow Deep Learning book, or from current research areas in deep learning. Hint: Pick a topic you will likely use in your CSCE 823 project or something you may need in your work at AFIT or elsewhere.

**For each topic:**

* Explain *why* you want to present that topic (e.g. need for research; will use in course project)
* Indicate at least 3 sources you intend to use to prepare your presentation on this topic (including book/article chapter/page info and any URLs).
* Describe what kinds of pre-class and learning activities you intend to prepare on this topic (e.g. worksheet, coding activity, demo, video, w/URLs; see learning activity description for ideas)
* Optional: For each topic, list other students who you have already discussed co-teaching the topic with.

Some example topic ideas:

* Data Augmentation Techniques
* Convolution over time-series signals: Temporal Convolutional Networks
* Deconvolution networks (generating new samples)
* Image style Transfer
* Image segmentation
* Point Cloud processing
* Set-invariant transforms & functions for processing unordered sets
* High-notoriety architectures (e.g. Inception Network; ResNET; UNet)
* RNN extensions: LSTMs, GRUs, Bi-Directional RNNs
* Combining Techniques (e.g. CNN) with Deep Reinforcement Learning
* Generative Adversarial Networks
* Attention Mechanisms
* Embeddings (e.g. word2vec)
* Techniques for Natural Language Processing (e.g. Transformer Networks)
* “One shot learning” & Siamese networks / Triplet Loss functions
* Pretraining; Transfer Learning
* Unsupervised and semi-supervised learning:
  + T-distributed Stochastic Neighbor Embedding (T-SNE)
  + Autoencoders (be specific on type if you have a preference (e.g. denoising; variational)
    - Latent-space regularization using specialized loss functions
  + Active Learning / semisupervised learning

**Pre-Class and Learning Activity Submission**

(due 72 hours before the lecture presentation – 5 points)

Use this submission portal to provide the learning activities for your topic in a single MS Word or PDF document. You should aim for a student spending about 1 hour of activities for students to work on outside of class, however, you can provide additional optional content for students seeking more info on the topic. Ideas to include are:

* Required: Topic overview (1 paragraph including why it is important for ML)
* Required: List of Learning goals/outcomes for your topic (aim for 3 goals/outcomes)
* Required: One paragraph describing your Lesson Plans, to include how the students should approach learning the topic using the learning activities you chose
* Required: One paragraph describing the intended format & flow of your live presentation (e.g. lecture, demo, discussion). If you are doing a joint lecture with other students, indicate who will do what for each portion, and give specific details on your portion.
* Required: Three (or more) items from the following set, with a short explanation & instructions of what the students should do to learn about this topic and whether they should do it before your presentation or after your presentation:
* Pointers to reading: from course text (include chapter/page) or other papers (provide link or PDF)
* Links to online content (videos/tutorials/code)
* Coding activities & demos (task and solutions)
* Worksheets (and solutions)
* Other in-class activity descriptions (MS Word / PDF)

**Lecture Content Submission**

(due 24 hours before the lecture presentation – will be shared on MS Teams - 10 points)

Use this submission portal to provide the digital content for your live topic presentation.    Include:

* Optional depending on format of your presentation:
* Lecture slides (PowerPoint or PDF) - include links to online content (videos/tutorials/code) if you will access them during the presentation.
* Code (python notebook) & Data: demos / interactives or short coding activities (URL)
* Other in-class activity descriptions (MS Word / PDF)

If you are submitting more than one file, zip first and submit the single zip file.

**Live Presentation (MS Teams)**

25 minutes per student; 3 students per class meeting

Standard Format: 20 minutes presentation w/5 min Q&A.

Alternate Format (requires instructor pre-approval): Guided structured discussion w/activities